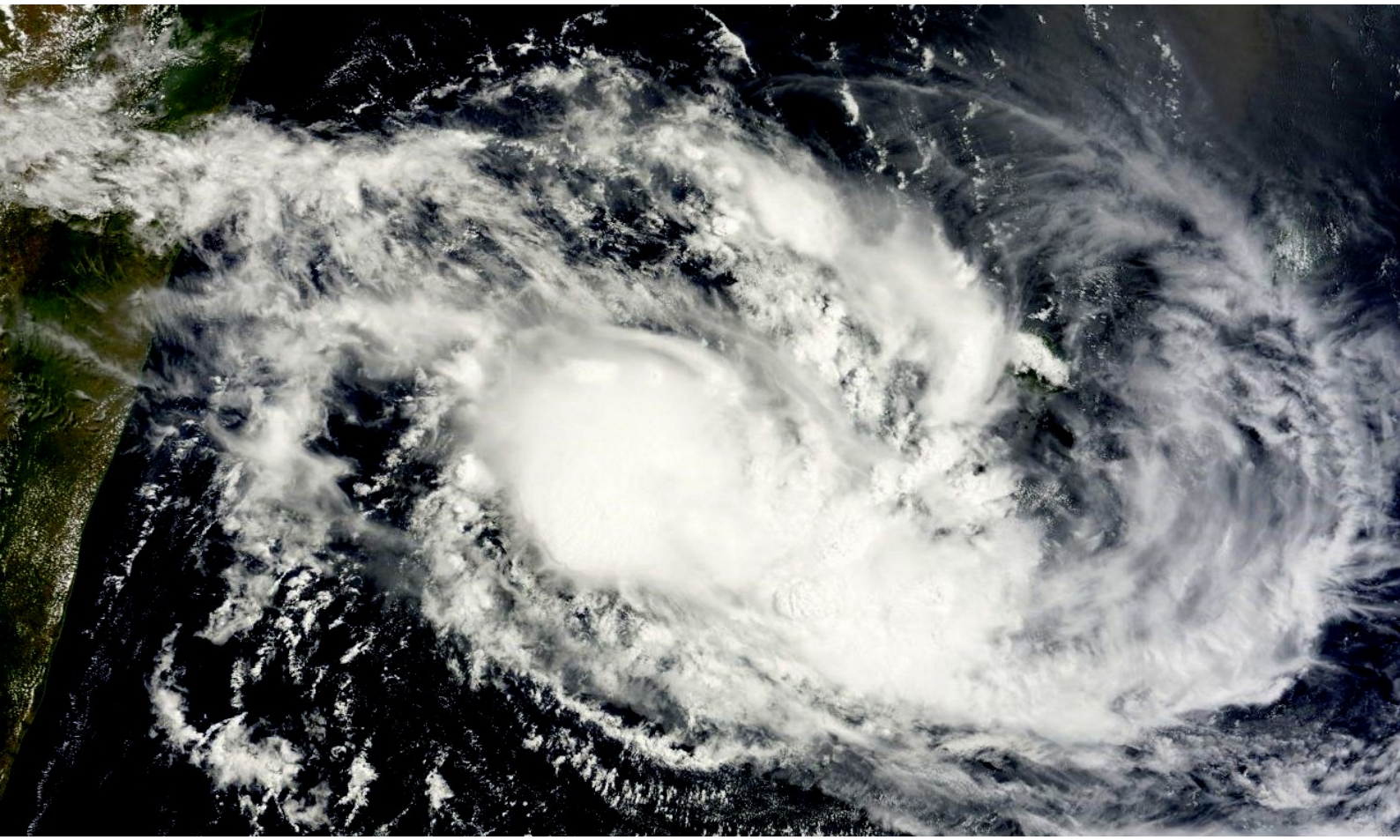
2017

Force Thirteen Cyclone Reports

Cyclone Carlos (201702)



Carlos was the second nameable storm of 2017, the first named operationally, and first hurricane strength cyclone of the year worldwide. Carlos ended a significant storm drought and affected the Mascarene Islands in early February.

Compiled by Nathan Foy at Force Thirteen, February 16, 2017
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Cover photo: MODIS enhanced satellite image of Cyclone Carlos on February 8, 2017

FORCE THIRTEEN

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1.1. Synoptic History

At the end of January, a new disturbance formed 355 miles east of Antalaha, Madagascar. The disturbance began with an exposed centre of circulation before beginning to organise in the first days of February, reaching depression status on February 3rd, and a tropical storm by early on the 4th.

Carlos began as a very compact system, displaying an eye-like feature briefly during February 4th before being replaced by a new convective outburst. The storm maintained its convective flare-up for over a day, and neared hurricane intensity. However, late on February 5th, wind shear began to displace the convection and by the early hours of the 6th, the storm ceased firing as the convection had been displaced to the southeast by over 50 miles.

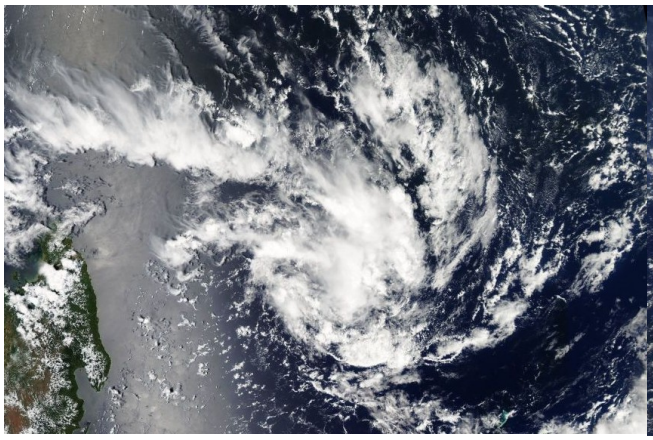
After briefly appearing to have lost tropical storm status, the storm then began a series of explosive bursts of convection as it veered southwest, just north of the Mascarene islands, with the fourth such burst being particularly impressive, peaking with cloud tops of –90 degrees Celsius on the evening of February 7th.

The storm then abruptly curved south and then southeastwards, where a ragged eye appeared for a few hours, enough to consider Carlos a Category 1 hurricane on the Saffir Simpson Hurricane Wind Scale.

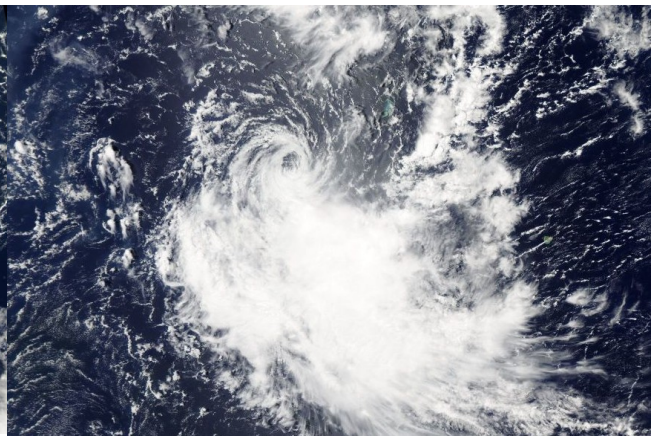
Continuing towards the southeast, Carlos resumed firing convection until midday on February 10th, and began to turn post-tropical as it reached 30 degrees South. By the end of the day, Carlos had completed its extratropical transition.

On the afternoon of February 12th, new low level convection began to circulate around the centre of the cyclone, and on that evening Carlos briefly attained Subtropical Storm status, before finally regressing back to an extratropical state early on the 13th.

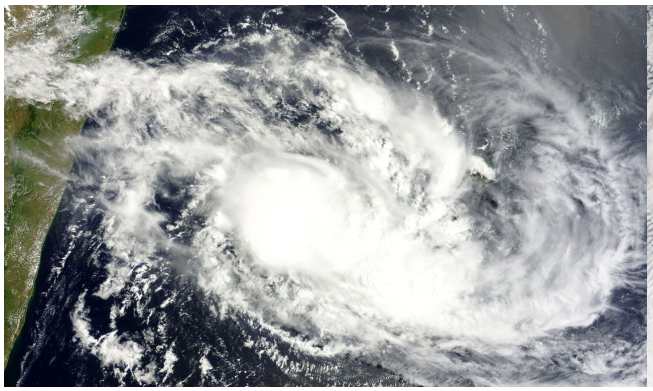
The extratropical remnants survived until February 16th.



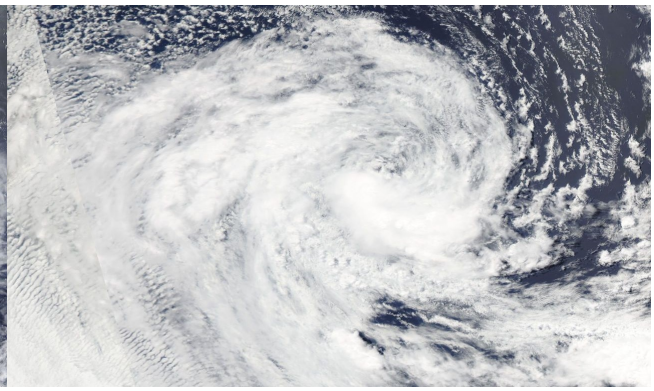
February 2nd



February 6th



February 8th



February 12th (Subtropical)

1.2. Best Track

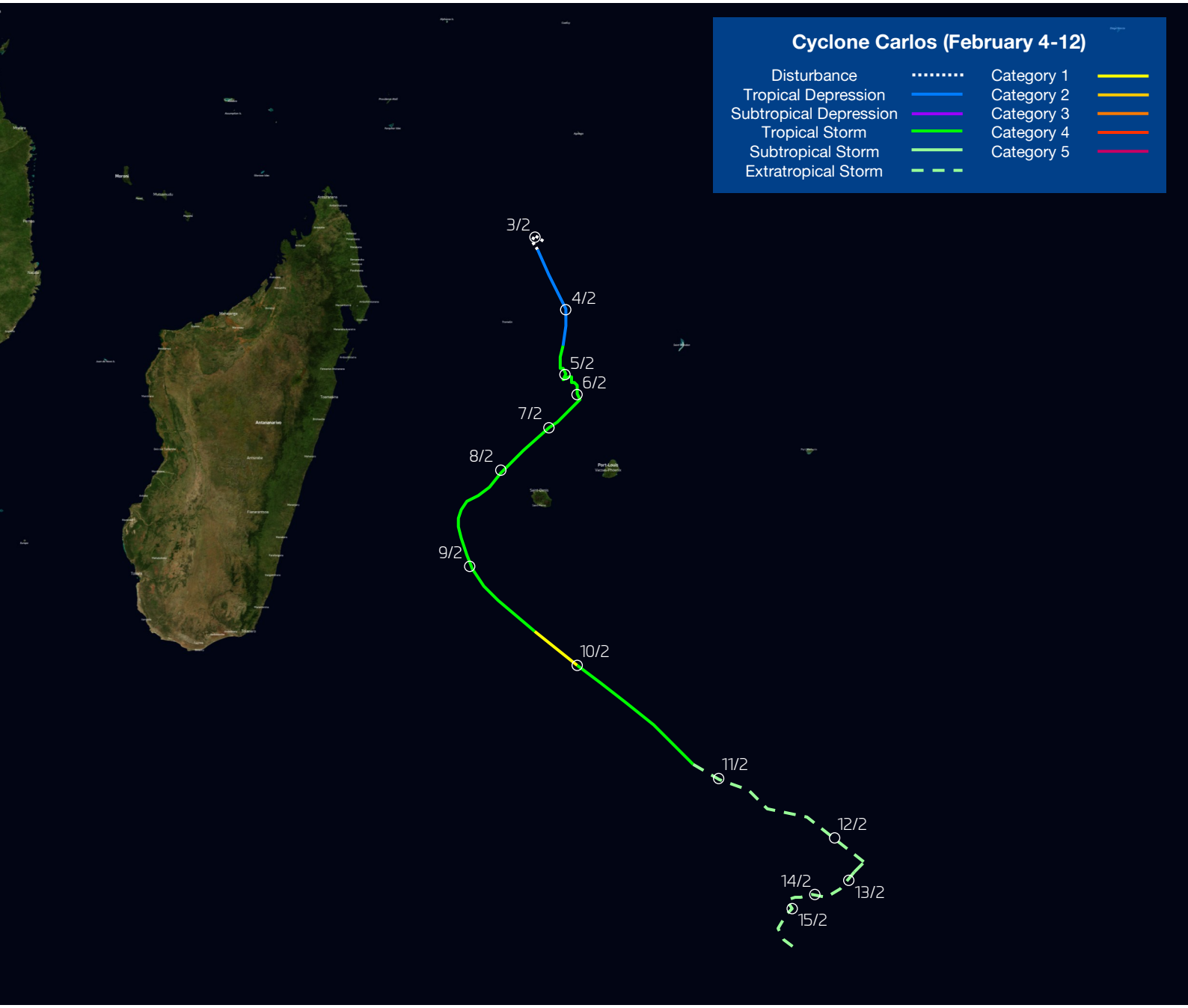
Below is the best track analysis from Force Thirteen, using Force Thirteen's SATOPS—a tool which uses infrared satellite imagery and cloud temperatures to estimate a storm's wind speed and air pressure. SATOPS does not take precedence over surface observations.

Date (dd/mm/yyyy)	Time	Latitude	Longitude	Wind (mph)	Pressure (mb)	Stage
02/02/2017	18:00	-13.7	56.1	30	1006	Disturbance
03/02/2017	00:00	-13.5	55.6	30	1005	Disturbance
03/02/2017	06:00	-13.7	55.3	30	1005	Disturbance
03/02/2017	12:00	-14.1	55.5	35	1003	Tropical Depression
03/02/2017	18:00	-14.7	56.3	35	1002	Tropical Depression
04/02/2017	00:00	-15.3	56.8	35	1000	Tropical Depression
04/02/2017	06:00	-15.9	56.8	35	998	Tropical Depression
04/02/2017	12:00	-16.7	56.5	45	995	Tropical Storm
04/02/2017	15:00	-16.9	56.4	45	995	Tropical Storm
04/02/2017	18:00	-17.1	56.5	50	992	Tropical Storm
04/02/2017	21:00	-17.1	56.6	50	992	Tropical Storm
05/02/2017	00:00	-17.2	56.7	60	987	Tropical Storm
05/02/2017	03:00	-17.6	56.6	65	987	Tropical Storm
05/02/2017	06:00	-17.5	57	65	986	Tropical Storm
05/02/2017	09:00	-17.4	57.1	70	985	Tropical Storm
05/02/2017	12:00	-17.7	57.1	70	985	Tropical Storm
05/02/2017	15:00	-17.7	57.2	65	986	Tropical Storm
05/02/2017	18:00	-17.8	57.2	65	987	Tropical Storm
05/02/2017	21:00	-17.9	57.2	65	987	Tropical Storm
06/02/2017	00:00	-18.1	57.3	60	988	Tropical Storm
06/02/2017	03:00	-18.3	57.3	60	989	Tropical Storm
06/02/2017	06:00	-18.3	57.2	60	990	Tropical Storm
06/02/2017	09:00	-18.4	57.2	50	991	Tropical Storm
06/02/2017	12:00	-18.5	57.2	50	994	Tropical Storm
06/02/2017	15:00	-18.5	57.1	45	995	Tropical Storm
06/02/2017	18:00	-18.6	56.9	45	995	Tropical Storm
06/02/2017	21:00	-18.7	56.5	45	995	Tropical Storm
07/02/2017	00:00	-18.9	56.2	50	993	Tropical Storm
07/02/2017	03:00	-19.2	55.8	45	995	Tropical Storm
07/02/2017	06:00	-19.5	55.5	50	992	Tropical Storm
07/02/2017	09:00	-19.7	55.2	50	992	Tropical Storm
07/02/2017	12:00	-19.9	54.7	50	992	Tropical Storm
07/02/2017	15:00	-20.1	54.2	50	992	Tropical Storm
07/02/2017	18:00	-20.4	53.8	50	991	Tropical Storm
07/02/2017	21:00	-20.5	53.7	60	990	Tropical Storm
08/02/2017	00:00	-20.8	53.2	60	989	Tropical Storm
08/02/2017	03:00	-21.3	52.6	65	987	Tropical Storm
08/02/2017	06:00	-21.8	52.3	65	988	Tropical Storm
08/02/2017	09:00	-22	51.9	60	990	Tropical Storm
08/02/2017	12:00	-22.4	52	60	991	Tropical Storm
08/02/2017	15:00	-22.6	52.3	65	989	Tropical Storm
08/02/2017	18:00	-22.9	52.8	65	987	Tropical Storm
08/02/2017	21:00	-23.2	52.8	70	985	Tropical Storm
09/02/2017	00:00	-23.4	53.1	70	983	Tropical Storm
09/02/2017	03:00	-23.6	53.4	70	981	Tropical Storm
09/02/2017	06:00	-23.7	53.6	65	981	Tropical Storm
09/02/2017	09:00	-24.1	53.9	70	979	Tropical Storm
09/02/2017	12:00	-24.4	54.2	70	978	Tropical Storm

1.2. Best Track (continued)

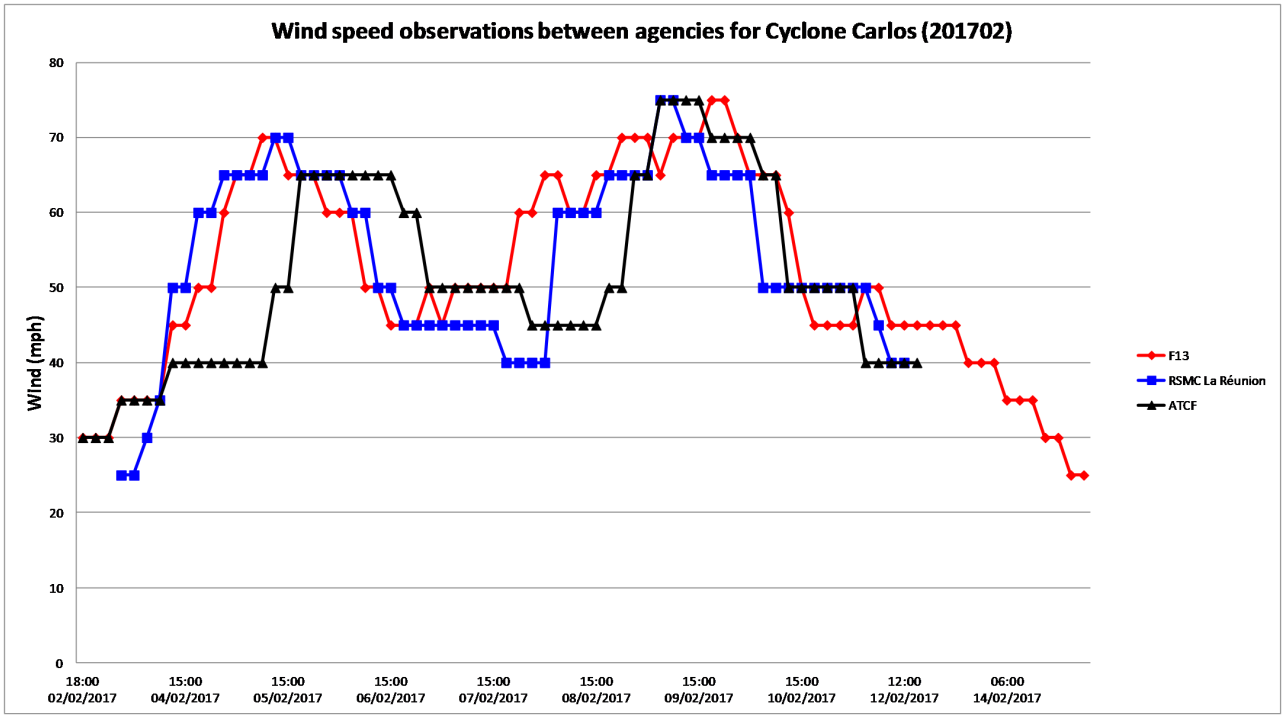
Date (dd/mm/yyyy)	Time	Latitude	Longitude	Wind (mph)	Pressure (mb)	Stage
09/02/2017	15:00	-24.7	54.6	70	977	Tropical Storm
09/02/2017	18:00	-25.2	55.1	75	976	Category 1
09/02/2017	21:00	-25.7	55.6	75	976	Category 1
10/02/2017	00:00	-26.3	56.1	70	976	Tropical Storm
10/02/2017	03:00	-26.6	56.7	65	978	Tropical Storm
10/02/2017	06:00	-27.1	57.3	65	980	Tropical Storm
10/02/2017	09:00	-27.5	57.8	65	979	Tropical Storm
10/02/2017	12:00	-28	58.3	60	981	Tropical Storm
10/02/2017	15:00	-28.5	59.2	50	985	Tropical Storm
10/02/2017	18:00	-29.1	60.2	45	989	Extratropical
11/02/2017	00:00	-29.4	62.1	45	989	Extratropical
11/02/2017	06:00	-29.9	63.9	45	990	Extratropical
11/02/2017	12:00	-29.9	64.3	45	990	Extratropical
11/02/2017	18:00	-30.3	64.6	50	989	Extratropical
12/02/2017	00:00	-30.4	66.1	50	989	Extratropical
12/02/2017	06:00	-30.9	67.4	45	991	Extratropical
12/02/2017	12:00	-31.4	66.8	45	992	Extratropical
12/02/2017	18:00	-31.4	67.2	45	992	Extratropical
12/02/2017	21:00	-31.8	67	45	993	Subtropical Storm
13/02/2017	00:00	-32.3	66.7	45	992	Extratropical
13/02/2017	06:00	-32.5	65.5	45	993	Extratropical
13/02/2017	12:00	-32.4	65.6	40	994	Extratropical
13/02/2017	18:00	-32.3	64.6	40	995	Extratropical
14/02/2017	00:00	-32.4	64.2	40	995	Extratropical
14/02/2017	06:00	-32.5	64	35	997	Extratropical
14/02/2017	12:00	-32.6	63.8	35	997	Extratropical
14/02/2017	18:00	-33.3	63.9	35	998	Extratropical
15/02/2017	00:00	-33.8	63.8	30	1000	Extratropical
15/02/2017	06:00	-34.1	63.3	30	1002	Extratropical
15/02/2017	12:00	-34.8	63.8	25	1004	Extratropical
15/02/2017	18:00	-34.8	63.9	25	1004	Extratropical

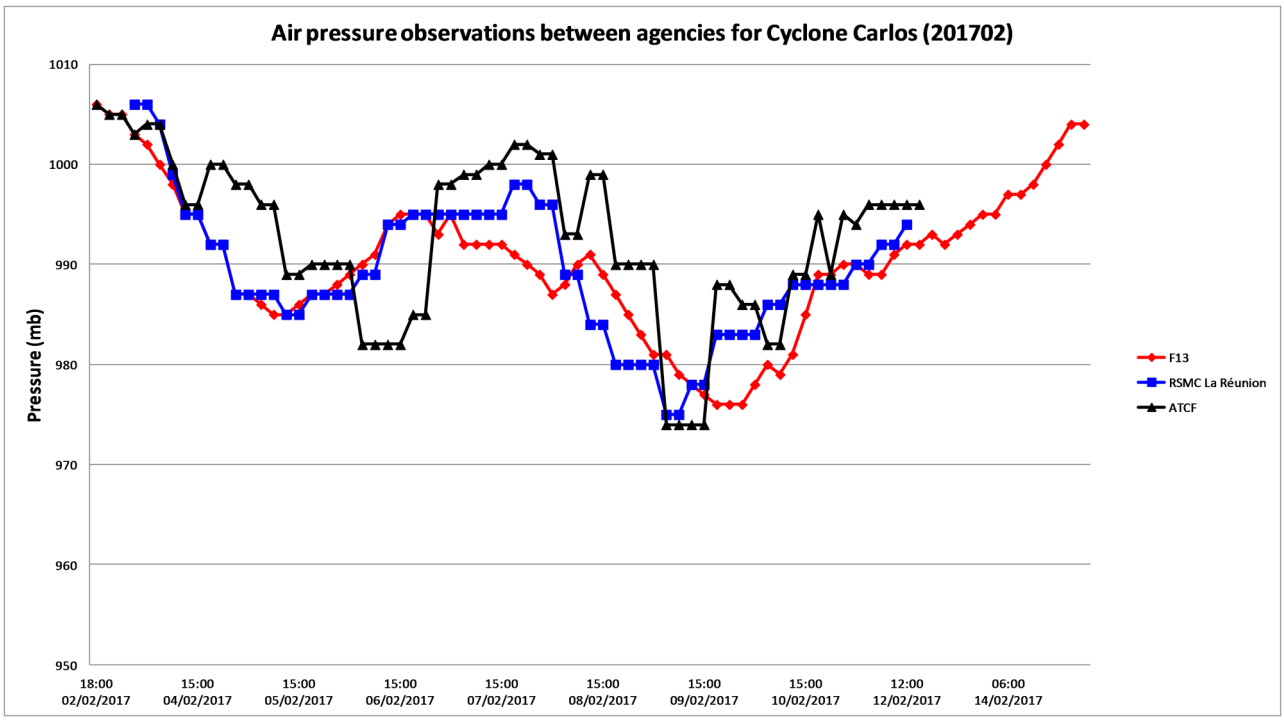
1.3. Track Chart



1.4. Comparison with other agencies

Carlos was monitored by the Regional Specialized Meteorological Centre in La Réunion, and by the U.S. Joint Typhoon Warning Center. Below compares how the three organisations compared with each other in terms of observed strength and intensity of Cyclone Carlos.





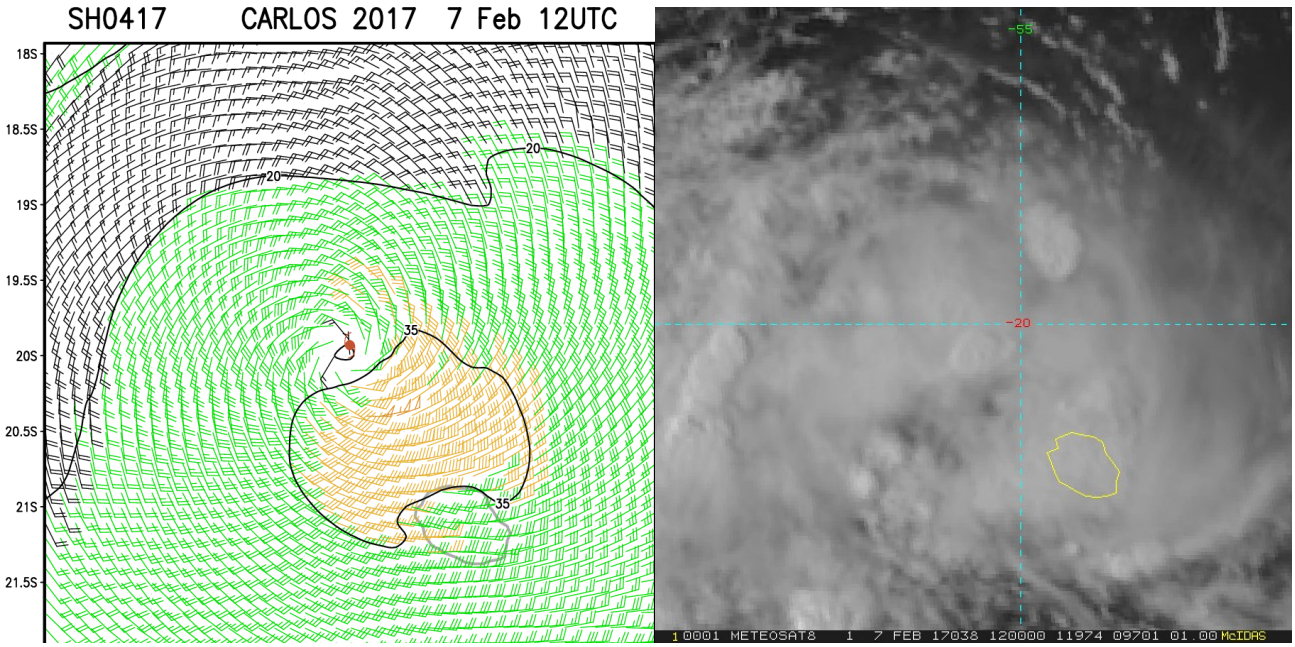
2. Effects on Land

Upon naming of Cyclone Carlos on February 4th, Meteo France issued a Cyclone Pre-Alert for Réunion island, a state of alert that was never upgraded during the passage of the storm. However, as the storm drew near, rain warnings were issued for the northeastern half of the island. Later, during Carlos's large flare-up to the west of Réunion, rainfall and convective activity affected the western side of the island.

In Mauritius, a Class I warning was issued shortly after the formation of Carlos, and was upgraded to Class II warnings on February 5th, when the storm was around 200 miles away. Whilst it appeared for a short time as though Class III warning criteria had been met, the warning was never raised.

Ultimately, Carlos never made landfall, though it passed within 150 miles of Mauritius and 100 miles from Réunion. As wind shear pushed the storm's convection to the southeast, rainfall over Mauritius was significant as a result. The highest 24 hour rain total was 242.2mm at Mare aux Vacoas in the southern half of the island. The strongest sustained wind was at Le Morne, where winds reached 70mph.

Minor to moderate flooding was reported in Mauritius, particularly on the eastern side of the island. Conditions in Réunion are unknown but not thought to be particularly severe.



Satellite estimated winds and visible satellite image of Cyclone Carlos at 12:00 UTC on February 7th, whilst the storm was making its closest approach to Réunion.

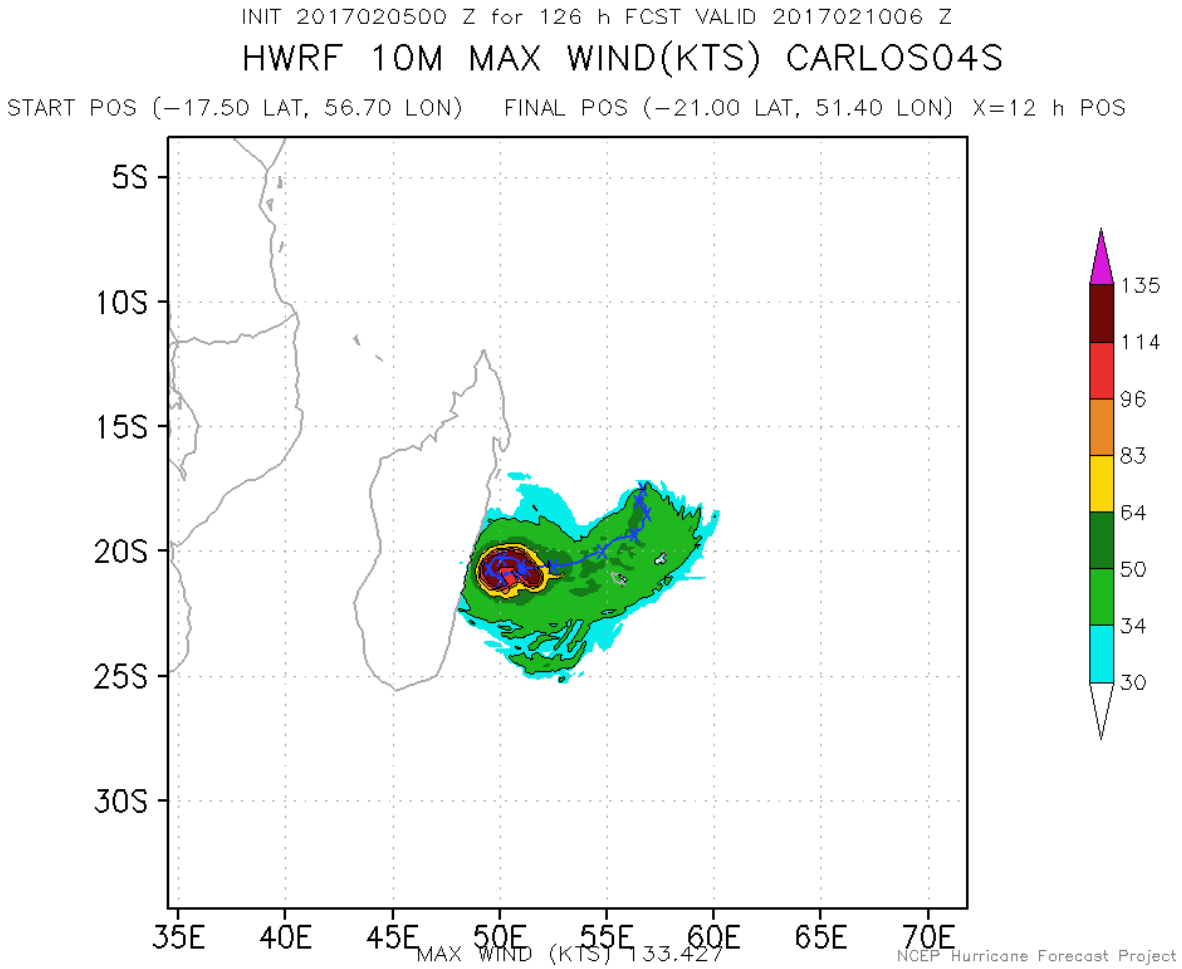
3. Forecasting Critique

As a matter of irony, the initial forecast for Cyclone Carlos was arguably the most accurate, at least in terms of track, intensity and timing. However, the forecasts twice called for a tropical storm landfall on Réunion which never materialised. The first forecast for Carlos also called for the storm to become a hurricane strength cyclone by the time the storm had cleared Réunion, which did occur.

During the storm, Force Thirteen's forecasts closely followed RSMC La Réunion's forecasts, which turned out to be more accurate than the Joint Typhoon Warning Center's products or any individual computer model.

Most of the JTWC's forecasts overestimated the storm, though this error diminished over time as the storm remained weaker than forecasted.

The HWRF model, which was the top performer in 2016, was a distant outlier during Carlos, with most of its simulations predicting a major hurricane strength cyclone—in particular one instance where the storm was forecasted to stall near Madagascar as a Category 4 cyclone for several days.



The HWRF model predicting a Category 4 cyclone stalling off the coast of Madagascar. This particular prediction was simulated on February 5th at 00:00 UTC.

4. Cyclone Destruction Potential Scale

The Cyclone Destruction Potential Scale (CDPS) is a new way of measuring cyclone impacts in a more meaningful way. For the past 45 years, storms worldwide have been measured using the Saffir-Simpson Hurricane Wind Scale, split into five categories. However, this scale measures wind alone, and does not correlate well with actual impacts on land, measured by monetary damage.
The CDPS measures other factors, such as storm size and forward speed as well as intensity to create a ten tiered scale that encompasses tropical storms as well as hurricanes.

Stage 1—Small or weak storms that are unlikely to cause a significant impact.
Stage 2—Generally disorganised storms that can cause significant damage.
Stage 3—Further organised systems that are likely to cause significant damage.
Stage 4—Somewhat powerful storms that are likely to cause extensive damage.
Stage 5—Powerful storms that are likely to cause devastating damages.
Stage 6—Very powerful storms that are likely to cause catastrophic damage.
Stage 7—Extremely powerful storms that are likely to cause catastrophic damage.
Stage 8—Super storms that are likely to cause incredible damage.
Stage 9—Super storms that may cause total damage.
Stage 10—Super storms that are likely to cause total damage.

Cyclone Carlos was the first storm to be observed by Force Thirteen using the CDPS—a method which was adopted in January 2017.

Carlos fluctuated between Stage 2 and 3 during its life, with the southern and eastern sides of the storm being the most dangerous. Carlos never rose far above the Stage 3 threshold whilst passing the Mascarene islands.

The Cyclone Destruction Potential Scale was created by Devon Williams in 2016. More information can be found at: https://drive.google.com/file/d/0B7pEWk6yHKggSE1STHg2UFJmbHM/view

4. Force Thirteen's Coverage on Carlos

Force Thirteen issued four video updates on Cyclone Carlos, and two hours of live coverage. The storm updates were unexpectedly popular given its lack of intensity, and viewer interaction was high.

Viewer approval rating during the storm was 96%.
The target audience for the storm updates was reached more on this instance than at any other time in the past, with over 38,000 viewers in Mauritius, 2,500 in Réunion, 2,100 in South Africa, and nearly 1,000 in France, among other countries.

Coverage on Carlos did cease after the storm cleared the island of Réunion, and after Force Thirteen HQ experienced technical difficulties on February 6th.

Comments, suggestions and inquiries should be directed to force-13@hotmail.co.uk, or any of Force Thirteen's online platforms.